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GUIDE FOR PREPARATION OF DIAGRAMS, CHARTS AND TABLES FOR ELECTROTECHNOLOGY

PART III GENERAL REQUIREMENTS FOR DIAGRAMS

(Second Reprint JUNE 1998)

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GUIDE FOR PREPARATION OF DIAGRAMS, CHARTS AND TABLES FOR ELECTROTECHNOLOGY

PART III GENERAL REQUIREMENTS FOR DIAGRAMS

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(*Continued on page* 2)

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GUIDE FOR PREPARATION OF DIAGRAMS, CHARTS AND TABLES FOR ELECTROTECHNOLOGY

PART III GENERAL REQUIREMENTS FOR DIAGRAMS

0. FOREWORD

0.1 This Indian Standard (Part III) was adopted by the Indian Standards Institution on 24 February 1977, after the draft finalized by the Electrotechnical Standards Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 A great number of standards have been published on graphical symbols for use on diagrams in the field of electrotechnology (*see* various parts of IS: 2032*). After having covered most of the needs for graphical symbols, with the exception of those for new fields of electrotechnology still under consideration, it has been found advisable to supplement the symbol publications with standards for the preparation of diagrams.

0.3 This standard will include definitions and classification of diagrams, charts and tables; guiding principles for use and combination of graphical symbols; guiding principles for preparation of diagrams; guiding principles for supplementing or replacing diagrams by charts and tables; item designation; etc.

0.4 This standard is being brought out in five parts as follows:

Part I	Definitions and classification
Part II	Item designation
Part III	General requirements for diagrams
Part IV	Circuit diagrams
Part V	Interconnection diagrams and tables

0.5 The principles given in this standard apply to all types of electrical diagrams and are additional to those given for each type of diagram in other parts of the standard.

0.6 While preparing this standard, assistance has been derived from IEC Pub 113-3 (1974) 'Diagrams, charts, tables : Part 3 General recommendations for the preparation of diagrams' issued by the International Electrotechnical Commission (IEC).

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*Graphical symbols used in electrotechnology.

1. SCOPE

1.1 This standard (Part III) lays down general requirements for the preparation of electrical diagrams, such as circuit and interconnection diagrams.

2. DRAWING SIZES

2.1 Preferably drawing sizes according to the international A-series (*see* IS : 1064-1961*) should be used.

2.2 The choice of drawing sizes should be decided after taking into account the following points:

a) Volume and complexity of the design,

b) Level of knowledge of personnel who will use the diagrams,

c) Use of smaller size but increase in the number of sheets,

d) Requirements of filing and handling,

e) Requirements of microfilming, and

f) Requirements of computer-aided design.

2.3 All sheets of a multi-sheet document shall be numbered in a manner which will relate them to one another.

3. APPLICATION OF GRAPHICAL SYMBOLS

3.1 Different Kinds of Graphical Symbols — In IS : 2032† different kinds of symbols are shown, for example:

a) For items – block symbols, complete symbols.

b) For parts of symbols — general symbols, qualifying symbols, supplementary symbols.

3.1.1 In some cases, symbols of different forms are shown, for example:

a) Preferred form, other forms;
b) Simplified form, complete form;
c) For position or stage — closed, latched, engaged;
d) For diagrams — single-line, multi-line; and
e) For both large and small scale maps — planned, in service.

3.2 Combinations and Composition of Symbols

3.2.1 All the possible examples are not covered in IS : 2032†. Any symbol may be composed by combining together the existing symbols in this standard, as well as with the letter symbols of IS : 3722-1966‡.

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*Specification for paper sizes (*revised*).
†Graphical symbols used in electrotechnology.
‡Specification for letter symbols and signs used in electrical technology.

3.2.1.1 The use of qualifying or supplementary symbols given in certain parts of IS : 2032* is not limited only to the standard in which they appear.

3.2.1.2 If the required parts for building a symbol are not found in Indian Standards, graphical or letter symbols established by other sources may be used, but in such a case their meaning should be clearly stated.

3.3 Choice of Symbols for a Diagram

3.3.1 When IS : 2032* shows alternative forms, in principle the basic rules for the choice of a symbol should be:

a) to use the simplest form of symbol adequate for the particular purpose,

b) to use a preferred form wherever possible, and

c) to use the chosen forms consistently throughout the same set of technical documentation.

3.3.2 *Example of Choice of Symbols*

3.3.2.1 For a relatively simple explanatory diagram, such as a block diagram, and especially where single-line representation can be used, it is sufficient in many cases to use general or simplified form symbols. An example showing a general or simplified form symbol for a transformer is given in Fig. 1.

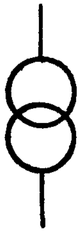

FIG. 1 EXAMPLE OF A GENERAL OR SIMPLIFIED FORM SYMBOL

3.3.2.2 For an explanatory diagram intended to facilitate a detailed study, such as a circuit diagram, the general symbol may not be sufficient. For example, for the transformer it may be necessary to use a more detailed symbol including supplementary or qualifying symbols showing the connection of windings and the vector symbol group according to IS : 2026-1962†. An example showing a detailed symbol using supplementary or qualifying symbols for a transformer is given in Fig. 2.

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*Graphical symbols used in electrotechnology.

†Specification for power transformers.

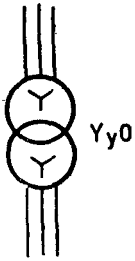

FIG. 2 EXAMPLE OF A DETAILED SYMBOL USING SUPPLEMENTARY OR QUALIFYING SYMBOLS

3.3.2.3 For a diagram, in which all the parts, such as windings, terminals and their designations have to be shown in detail, it may be necessary to use the complete form symbol. An example showing a complete form symbol for a transformer is given in Fig. 3.

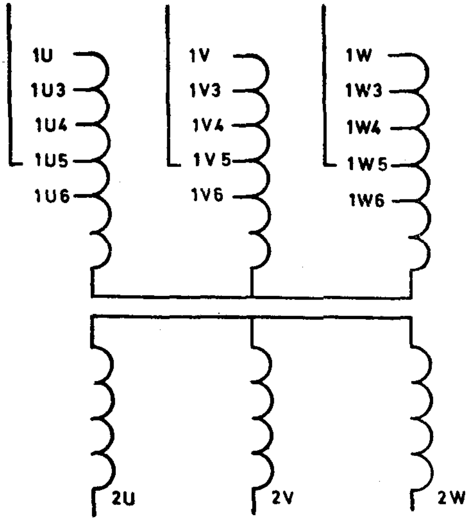

FIG. 3 EXAMPLE OF A COMPLETE FORM SYMBOL

3.4 Symbol Size, Line Thicknesses

3.4.1 In most cases the meaning of a symbol is defined by its *form*. The *size* and the line *thickness* do not, as a rule, affect the meaning of the symbol.

3.4.2 In some cases it may be desirable to use different sizes of symbols:

a) to emphasize certain aspects, and

b) to facilitate the inclusion of additional information.

3.4.2.1 In Fig. 4, a machine set consisting of a 3-phase generator is shown in two different manners. The left-hand variant uses symbol sizes as shown in IS : 2032 (Part IV)-1964*. The right-hand variant shows the 3-phase generator symbol larger than the exciter symbol.

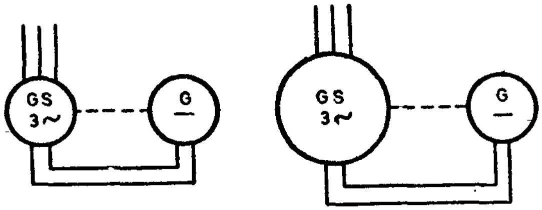

FIG. 4 A TYPICAL MACHINE SET

3.4.2.2 In Fig. 5, a binary logic AND element is shown to the left as in IS : 2032†. To the right the symbol size is increased to make possible the inscription of pin numbers, additional designations and other information.

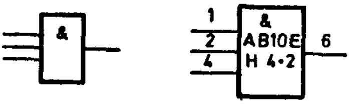

FIG. 5 A BINARY LOGIC AND ELEMENT

3.4.3 To emphasize or distinguish circuits different line thicknesses may be used for conductor symbols. Figure 6 shows a 3-phase transformer with a part of its associated switchgear and controlgear in which the power circuits are represented by heavier lines.

3.4.3.1 For additional emphasis thicker lines may be used for other symbols than those of conductors.

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*Graphical symbols used in electrotechnology: Part IV Rotating machines and transformers.

†Graphical symbols used in electrotechnology.

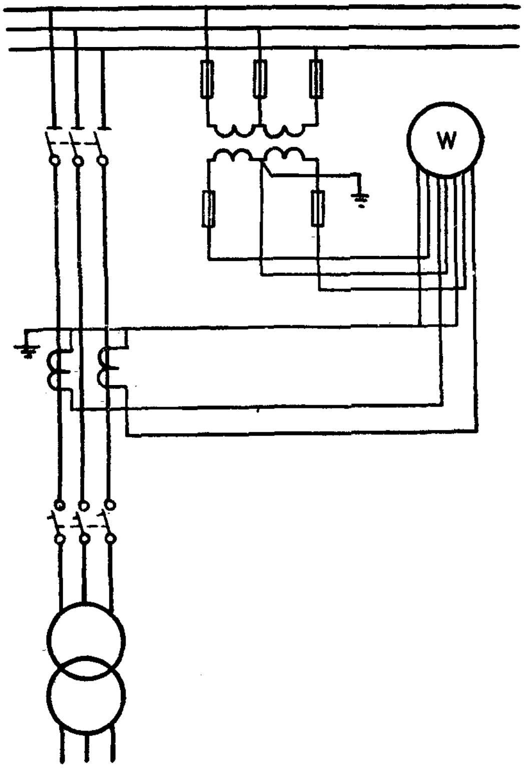

FIG. 6 DIFFERENT LINE THICKNESSES FOR CONDUCTOR SYMBOLS

3.5 Orientation of Symbols

3.5.1 The orientation of most symbols as shown in IS : 2032* is not mandatory. Unless otherwise indicated, symbols may be turned or mirror-imaged to avoid conductor bends and cross-overs.

3.5.2 When part of a symbol is derived from the characteristic curve of a device, this part of the symbol shall not be turned.

3.5.3 Waveforms or their stylized representations shall be shown the way they appear on an oscilloscope screen.

3.6 Representation of Terminals

3.6.1 In IS : 2032* terminal symbols are not generally used. In some special cases, the terminal symbols are part of the graphical symbols and shall be shown. However, generally it is not necessary to add symbols for terminals, brushes, etc, on the symbols for components.

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*Graphical symbols used in electrotechnology.

3.6.1.1 If for certain types of diagrams, it is necessary to give symbols representing terminals, these shall be in accordance with symbols given in **2.5.1** of IS : 2032 (Part II)1962*. In the same way, if symbols for brushes are necessary, they shall be chosen from **3.5** and **3.6** of IS : 2032 (Part IV)-1964†.

3.7 Representation of Conductors

3.7.1 In IS : 2032‡ symbols for components, machines, etc, are generally shown with conductors. In these cases, the conductor symbols are used as examples. Other ways of representing the conductors are permissible provided that the meaning of the symbol is not changed.

3.7.1.1 *Example of representing conductors* — For a frequency multiplier in single-line representation IS : 2032‡ shows the symbol as in Fig. 7. Other variants are permissible. For example, *see* Fig. 8.

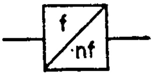

FIG. 7 SYMBOL FOR FREQUENCY MULTIPLIER,

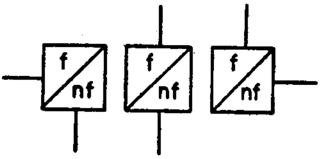

FIG. 8 VARIANTS OF SYMBOL OF FIG. 7

3.7.2 On the other hand, in a few cases the conductor symbols affect the meaning of the component symbol and shall, therefore, be drawn as shown in IS : 2032‡.

3.7.2.1 Example of conductor symbols affecting the meaning of graphical symbols are resistor (*see* Fig. 9) and relay coil (*see* Fig. 10).

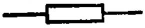

FIG. 9 RESISTOR

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*Graphical symbols used in electrotechnology: Part II Kind of current distribution systems and methods of connection.

†Graphical symbols used in electrotechnology: Part IV Rotating machines and transformers.

‡Graphical symbols used in electrotechnology.

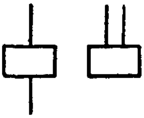
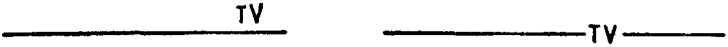


FIG. 10 RELAY COILS

4. CONNECTING LINES

4.1 Identification of Connecting Lines — Connecting lines, whether single or in groups, shall be identified. This identification, which may be near the line or in a gap in the line may also serve to indicate destination. For example, *see* Fig. 11.



11A Identification Near the Line 11B Identification in a Gap in the Line

FIG. 11 IDENTIFICATION OF CONNECTING LINES

4.2 Multi-line Representation — Where there are a number of parallel lines representing conductors they may be arranged according to their function in groups separated from each other by spaces wider than those between the lines of a group. If grouping according to function is not practicable, it is helpful to arrange the lines in arbitrary groups of not more than three. For example, *see* Fig. 12.

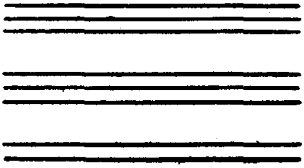


FIG. 12 GROUPING OF PARALLEL LINES

4.3 Single-Line Representation — Single-line representation, the essential purpose of which is to avoid a multiplicity of parallel lines, may be used in a multi-line diagram. For example, *see* Fig. 13.

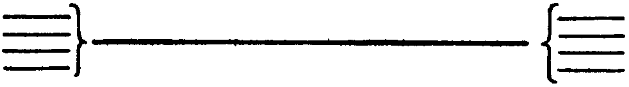


FIG. 13 SINGLE-LINE REPRESENTATION

4.3.1 If the terminations of a group of lines are consecutively numbered at each end, as in Fig. 14 (multi-line representation), a simplified representation as shown in Fig. 15 may be used.

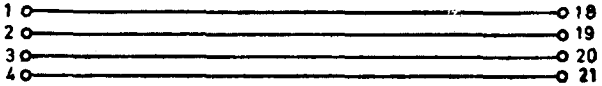


FIG. 14 CONSECUTIVE NUMBERING OF A GROUP OF LINES

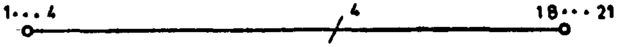


FIG. 15 SIMPLIFIED REPRESENTATION OF A GROUP OF CONSECUTIVELY NUMBERED LINES

4.3.2 If the terminations are not in the same order they shall be designated as shown in Fig. 16.

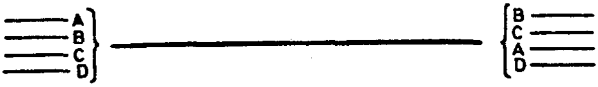


FIG. 16 SIMPLIFIED REPRESENTATION WHEN TERMINATIONS ARE NOT IN SAME ORDER

4.3.3 The method shown by symbols in **2.4.9** of IS : 2032 (Part II)-1962* shall be used when a single line represents a group of conductors. In this case it is always necessary to show an identification mark at each conductor symbol. For example, *see* Fig. 17.

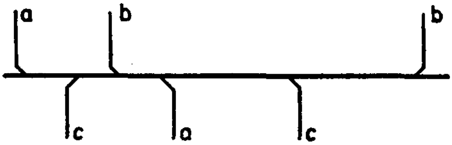


FIG. 17 IDENTIFICATION MARK AT EACH CONDUCTOR SYMBOL

4.4 Omitting Lines — When a line representing a conductor crosses a relatively large part of a diagram, most part of the line may be omitted and the connection indicated by references. For example, *see* Fig. 18.

Groups of lines on a diagram may be omitted for most of their length, provided their ends are enclosed by suitably referenced brackets. For example, *see* Fig. 19.

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*Graphical symbols used in electrotechnology : Part II Kind of current distribution systems and methods of connection.

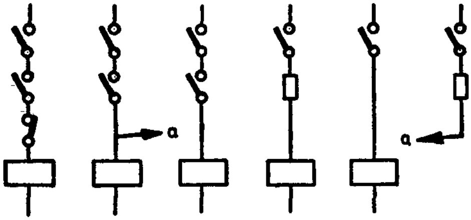


FIG. 18 OMITTING LINES

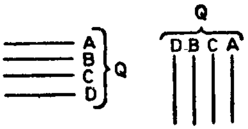


FIG. 19 OMITTING GROUPS OF LINES

4.5 Number of Conductors — In single-line representation, the number of conductors represented by a single symbol shall be indicated where necessary. IS : 2032* gives many examples of how this should be done. For additional examples, *see* Fig. 20 and 21.

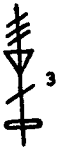
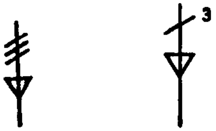


FIG. 20 ONE THREE-CONDUCTOR CABLE WITH SEALING END



Form 1 Form 2

FIG. 21 SIMPLIFIED FORMS OF ONE THREE-CONDUCTOR CABLE WITH SEALING END

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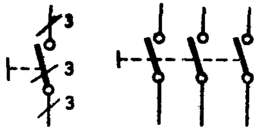
*Graphical symbols used in electrotechnology.

5. APPLICATION OF SINGLE-LINE REPRESENTATION TO APPARATUS

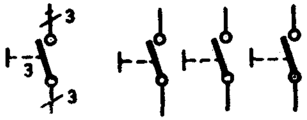
5.1 In single-line representation, the number of devices represented by a single symbol shall be indicated, where necessary. IS : 2032* gives many examples of how this should be done. For additional examples, *see* Fig. 22 to 26.

NOTE — Single-line representation can give rise to difficulties of interpretation and it should therefore be used with care. In case of doubt, the number of conductors should be indicated on either side of the symbol for the device.



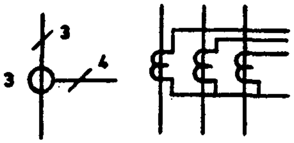
Single-Line Representation   Multi-Line Equivalent

FIG. 22 ONE THREE-POLE SWITCH, MANUALLY OPERATED



Single-Line Representation   Multi-Line Equivalent

FIG. 23 THREE SINGLE-POLE SWITCHES, EACH MANUALLY OPERATED



Single-Line Representation   Multi-Line Equivalent

FIG. 24 THREE CONDUCTORS, EACH WITH A CURRENT TRANSFORMER AND A TOTAL OF FOUR SECONDARY CONNECTIONS BROUGHT OUT

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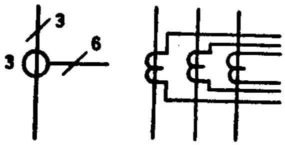
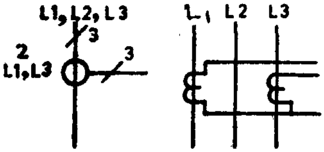
*Graphical symbols used in electrotechnology.



Single-Line Representation

Multi-Line Equivalent

Fig. 25 Three Conductors, Each with a Current Transformer and a Total of Six Secondary Connections Brought Out



Single-Line Representation

Multi-Line Equivalent

Fig. 26 Three Conductors, Two of Which have a Current Transformer, with a Total of Three Secondary Connections Brought Out

6. METHODS OF INDICATING SYMBOL LOCATION

6.1 There are several satisfactory methods of indicating symbol location. The zonal reference system which finds general application is described in **6.2**.

Note — Some other methods, applicable to circuit diagrams, will be described in IS : 8270 (Part IV)*.

6.2 Zonal Reference System

6.2.1 In this system, each sheet is divided into rectangular zones which are identified, for example, by numbers from left to right (columns) and letters from top to bottom (rows). For example, *see* Fig. 27.

6.2.2 The width and height of the zones may depend on the size of the sheet and the complexity of the diagram.

6.2.3 The location of each symbol or circuit in a diagram can be indicated by the number and letter of the zone containing the symbol or circuit. In certain cases it may be sufficient to use only a column or row designation.

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*Guide for preparation of diagrams, charts and tables for electrotechnology: Part IV Circuit diagrams (*under preparation*).

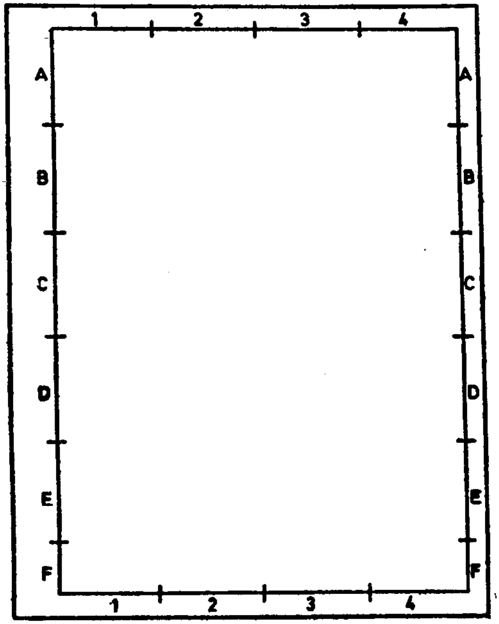

FIG. 27 ZONAL REFERENCE SYSTEM

6.2.4 The method of referencing shall be consistent. For example, *see* Table 1.

TABLE 1 EXAMPLES OF REFERENCING

FOR REFERRING TO	WRITE REFERENCE AS BELOW
Horizontal zone G on the same sheet	G
Column 7 on the same sheet	7
Rectangular zone G7 on the same sheet	G7
Rectangular zone G7 on sheet 34 of the same diagram (that is, with the same drawing number)	34/G7
Rectangular zone G7 of single-sheet diagram No. 4568	Diagram 4568/G7
Rectangular zone G7 on sheet 34 of diagram No. 5796	Diagram 5796/34/G7

If there is a risk, when using the diagram, of confusing the zonal reference of the symbol with other designations referring to the actual equipment, the zonal reference should be written in parenthesis.

7. OPERATIONAL STATE TO BE REPRESENTED

7.1 Apparatus shall normally be shown in the de-energized or unoperated position or state. For example, relay contacts shall be shown in the de-energized state of the relay.

7.2 It is essential that parts of a multi-switching device are shown in a mutually consistent position or state, irrespective of whether the circuit is in the unoperated condition or not.

7.3 To avoid ambiguity a special indication on the diagram (for example, by a note or a chart) is needed:

a) for apparatus which may rest in any one of two or more positions or states, and

b) if it is essential to show a circuit in a particular operated position or state.

7.4 Switches of circuits for emergency, standby, alarm, etc, shall be shown in the positions which they occupy during normal service of the equipment or in a specific defined condition (for example, aircraft on the ground).

7.5 Test switches and similar devices shall be shown in normal position, and not in test position.

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